Chapter 1 - Introduction

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Chapter Highlights

In 1949, the U.S. Atomic Energy Commission created what is now the Idaho National Engineering and Environmental Laboratory (INEEL) as the National Reactor Testing Station to build and test nuclear power reactors. The INEEL occupies approximately 2300 km^2 (890 mi^2) of the upper Snake River Plain in southeastern Idaho. Over the life of the INEEL, 52 types of reactors, associated research centers, and waste handling areas have been constructed and tested.

The INEEL serves as a multiprogram national laboratory that delivers science and engineering solutions to the world's environmental, energy, and security challenges in four core areas:

- Science-based, engineered solutions to the challenges of the U.S. Department of Energy's (DOE's) mission areas, other federal agencies, and industrial clients.
- Completion of environmental cleanup at the INEEL.
- Enhancement of scientific and technical talent, facilities, and equipment to best serve national and regional interests.
- Leadership and support to the Environmental Management mission throughout the DOE complex.

There are nine primary facility areas and three smaller secondary facilities at the INEEL and in Idaho Falls. Six of the nine primary facilities and the secondary facilities are operated by the INEEL Management and Operating contractor, Bechtel BWXT, Idaho, LLC. The University of Chicago, British Nuclear Fuels Limited, Inc. and Bechtel Bettis, Inc. operate three additional facilities on the INEEL.

Approximately 7000 people work at the INEEL, making it the largest employer in eastern Idaho and one of the top five employers in the State. The INEEL has a tremendous economic impact on eastern Idaho. The INEEL has infused more than $750 million dollars into the Idaho economy.

1. INTRODUCTION

This report presents the results and activities of organizations performing environmental monitoring on the Idaho National Engineering and Environmental Laboratory (INEEL) and surrounding areas for calendar year 2003. Environmental monitoring results are transmitted to the U.S. Department of Energy Idaho Operations Office (DOE-ID) and other government agencies.

The INEEL is owned by DOE and administered through its Idaho Operations Office. The INEEL Site occupies approximately 2300 km^2 (890 mi^2) of the upper Snake River Plain in southeastern Idaho (Figure 1-1). It is roughly equidistant from Salt Lake City, Utah (328 km [203 mi]); Butte, Montana (380 km [236 mi]); and Boise, Idaho (450 km [280 mi]). The communities closest to the INEEL are Atomic City (population 45), Arco (population 1026), Howe (population 33), Monteview (population 10), Mud Lake (population 270), and Terreton (population 100). The larger population centers of Idaho Falls (population 50,730), Blackfoot (population 10,419), and Pocatello (population 51,466) are at least 35 km (22 mi) from the nearest INEEL boundary (Figure 1-2). Ten Idaho counties are located in part or entirely within 80 km (50 mi) of the INEEL (Figure 1-2). The INEEL encompasses portions of five counties (Bingham, Bonneville, Butte, Clark, and Jefferson).

Figure 1-1. Location of the INEEL.

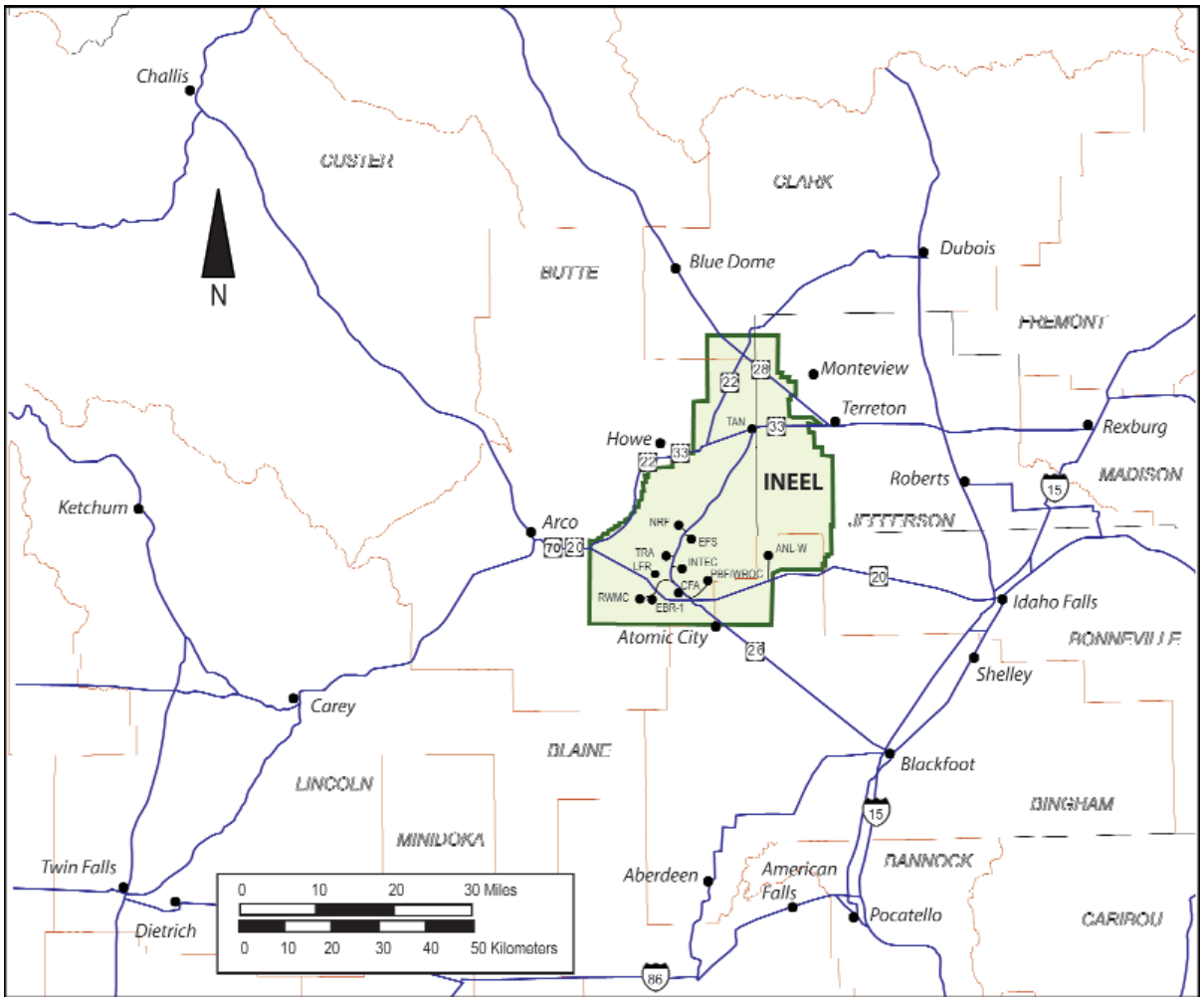

Figure 1-2. Map of INEEL and surrounding area showing facilities, counties, and cities.

1.1 INEEL Mission and Facilities

The INEEL's vision is to serve as a multi-program national laboratory that delivers science and engineering solutions to the world's environmental, energy, and security challenges. The mission of the INEEL can be divided into four core areas:

- Deliver science-based, engineered solutions to the challenges of DOE's mission areas, other federal agencies, and industrial clients;
- Complete environmental cleanup responsibly and cost effectively using innovative science and engineering capabilities;
- Provide leadership and support to optimize the value of Environmental Management (EM) investments and strategic partnerships throughout the DOE complex; and

- Enhance scientific and technical talent, facilities, and equipment to best serve national and regional interests (INEEL Mission/Vision 2001).

Over the years, various Management and Operating (M&O) contractors have operated the INEEL. During 2003, the INEEL M&O contractor was Bechtel BWXT Idaho, LLC (BBWI). The University of Chicago's Argonne National Laboratory, Bechtel Bettis, Inc. (BBI), and British Nuclear Fuels Limited, Inc. (BNFL) operate other facilities. The M&O operates facilities at the Site and in Idaho Falls, Idaho. There are nine primary facility areas and three smaller secondary facilities at the INEEL and in Idaho Falls (Figure 1-2). These facility areas are described below.

Argonne National Laboratory-West

Argonne National Laboratory-West (ANL-W) is the prime testing center in the United States for demonstration and proof-of-concept of nuclear energy technologies. Research is focused on areas of national concern relating to energy, nuclear safety, nonproliferation, decommissioning and decontamination, and remote handling of nuclear materials. The University of Chicago operates ANL-W for the DOE Chicago Operations Office (DOE-CH). The DOE-CH Argonne Area Office (AAO) supports local operations.

Central Facilities Area

The Central Facilities Area (CFA) provides centralized support for the INEEL, including administrative offices, research laboratories, medical and fire services, security headquarters, warehouses, crafts, vehicle support, and a cafeteria.

Idaho Falls Facilities

Idaho Falls facilities include the INEEL Research Center (IRC), where researchers conduct fundamental and applied research in science and engineering areas crucial to DOE's national missions. Additional support personnel for the facilities at the INEEL are housed at the Willow Creek Building, Engineering Research Office Building, one DOE building, and other office buildings.

Idaho Nuclear Technology and Engineering Center

The primary mission of the Idaho Nuclear Technology and Engineering Center (INTEC) is to safely store spent nuclear fuel and prepare it for shipment to an offsite repository. The facility also developed technology for the safe treatment of high-level liquid radioactive wastes.

Naval Reactors Facility

The Naval Reactors Facility (NRF) is operated for the U.S. Naval Nuclear Propulsion Program by BBI, Bettis Atomic Power Laboratory-Idaho. Developmental nuclear fuel material samples, naval spent fuel and irradiated reactor plant components/materials are examined at the Expended Core Facility (ECF). The knowledge gained from these examinations is used to improve current reactor designs and to monitor the performance of existing reactors. The naval spent fuel examined at ECF is critical to the design of longer-lived cores, which minimizes the

creation of spent fuel requiring long-term disposition. NRF is also preparing the current inventory of naval fuel for dry storage and eventual transportation to a repository.

Power Burst Facility/Critical Infrastructure Test Range

During its operation, the Power Burst Facility (PBF) supported numerous nuclear safety studies related to commercial nuclear power plants. Currently, the PBF is undergoing decontamination activities in preparation of dismantlement. The Critical Infrastructure Test Range (CITR) is home to the INEEL's National Security Programs division. This area provides space for numerous test programs and pilot-scale demonstrations related to Homeland and National security.

Radioactive Waste Management Complex

The Radioactive Waste Management Complex (RWMC) manages solid transuranic and low-level radioactive waste. The facility supports research projects dealing with waste retrieval and processing technology and provides temporary storage and treatment of transuranic waste destined for the Waste Isolation Pilot Plant (WIPP) in New Mexico. BNFL, Inc. is currently preparing the Advanced Mixed Waste Treatment Facility for operation. This facility will retrieve mixed transuranic waste in temporary storage, treat the waste to meet disposal criteria, and package the waste for shipment to WIPP.

Test Area North

Located at the north end of the INEEL, Test Area North (TAN) was originally built to house the nuclear powered airplane project during the 1950s. Currently, the TAN facilities support two projects. The Specific Manufacturing Capability (SMC) Project, conducted at the TAN facility, manufactures protective armor for the U.S. Army M1-A1 and M1-A2 Abrams tanks. TAN personnel also research technologies for the cleanup of environmental contamination from prior operations. This research includes alternatives such as biological remediation of organic solvents in groundwater.

Test Reactor Area

The Test Reactor Area (TRA) is dedicated to nuclear technology research. The Advanced Test Reactor is used to study the effects of radiation on materials, test nuclear fuels, and to produce rare and valuable medical and industrial isotopes.

Three secondary facilities at the INEEL include a national historic landmark, a former dairy farm, and a live-fire gun range. These three facilities provide the INEEL with public relations, environmental field station, and firearms training areas. Each of these facilities is described in the following sections.

Experimental Breeder Reactor No. 1

The Experimental Breeder Reactor No. 1 (EBR-I) is a Registered National Historic Landmark located at the INEEL off U.S. Highway 20/26. It is open to the public, free of charge, every summer from the Memorial Day weekend through Labor Day.

At 1:50 p.m., on December 20, 1951, the first usable amount of electricity from a nuclear power reactor was generated. EBR-I's real mission was not to show that electricity could be generated by a nuclear reactor, but it was to determine whether scientists' theoretical calculations on fuel breeding could actually be achieved. EBR-I was also successful in this task, breeding (creating) more fuel than it consumed.

Experimental Field Station

The Experimental Field Station (EFS), first called the Experimental Dairy Farm (EDF), was established to conduct Controlled Environmental Radioiodine Tests (CERTs). The first CERT at EDF was conducted on September 2, 1964. The CERTs at EDF ended in 1970. The EFS was established in 1973 as a major environmental monitoring site with high- and low-volume air samplers. Since that time, the EFS has served as a field station for various experiments, the longest running being the Protective Cap/Biobarrier Experiment (see Chapter 9.12).

Live-Fire Range

The Live-Fire Range (LFR) has been used since 1990 for security force practice maneuvers, including small and large (machine gun and light-antitank weapons) arms target practice. The LFR includes a large firing range area surrounded on three sides by a 20-foot protective berm. This range also houses an interactive, indoor, live-fire range with computer controlled target simulations.

1.2 Physical Setting of the INEEL

The INEEL is located in a large, relatively undisturbed expanse of sagebrush steppe habitat. Approximately 94 percent of the land on the INEEL is open and undeveloped. The Site has an average elevation of 1500 m (4900 ft) above sea level, and it is bordered on the north and west by mountain ranges and on the south by volcanic buttes and open plain (Figure 1-1). Lands immediately adjacent to the INEEL are open rangeland, foothills, or agricultural fields. Agricultural activity is concentrated in areas northeast of the INEEL. Approximately, sixty percent of the INEEL is open to livestock grazing.

The climate of the high desert environment of the INEEL is characterized by sparse precipitation (less than 22.8 cm/yr [9 in./yr]), warm summers (average daily temperature of 15.7°C [60.3°F]), and cold winters (average daily temperature of -5.2°C [22.6°F]) (DOE-ID 1989). The altitude, intermountain setting, and latitude of the INEEL combine to produce a semiarid climate. Prevailing weather patterns are from the southwest, moving up the Snake River Plain. Air masses, which gather moisture over the Pacific Ocean, traverse several hundred miles of mountainous terrain before reaching southeastern Idaho. Frequently, the result is dry air and

little cloud cover. Solar heating can be intense with extreme day-to-night temperature fluctuations.

Basalt flows, which produce a rolling topography, cover most of the plain. Vegetation is visually dominated by big sagebrush (*Artemisia tridentata*). Beneath these shrubs are grasses and flowering plants, most adapted to the harsh climate. A recent inventory counted 409 plant species on the INEEL (Anderson et al. 1996). Vertebrate animals found on the INEEL include small burrowing mammals, snakes, birds, and several game species. Published species counts include six fishes, one amphibian, nine reptiles, 164 birds, and 39 mammals (Reynolds et. al. 1986).

The Big Lost River on the INEEL flows toward the northeast, ending in a playa area on the northwest portion of the Site. Here it evaporates or infiltrates into the subsurface. Surface water does not move offsite. The fractured volcanic rocks under the INEEL, however, form a portion of the eastern Snake River Plain Aquifer, which stretches 267 km (165 mi) from St. Anthony to Bliss, Idaho, and stores one of the most bountiful supplies of groundwater in the nation. An estimated 200 to 300 million acre-ft of water is stored in the aquifer's upper portions. The aquifer is primarily recharged from waters of the Henry's Fork and the South Fork of the Snake River, as well as the Big Lost River, the Little Lost River, Birch Creek, and irrigation. Beneath the INEEL, the aquifer moves laterally to the southwest at a rate of 1.5 to 6 m/d (5 to 20 ft/d) (Lindholm 1996). The Snake River Plain Aquifer emerges in springs along the Snake River between Milner and Bliss, Idaho. The primary use of both surface water and groundwater on the Snake River Plain is crop irrigation.

1.3 History of the INEEL

The geologic events that have shaped the modern Snake River Plain on and near the INEEL took place during the last 2 million years (Lindholm 1996, ESRF 1996). The plain, which arcs from far eastern Oregon across southern Idaho to Yellowstone National Park, marks the passage of the earth's crust over a plume of melted mantle material pressing upward. The resultant rhyolite volcanics are oldest in the western portion of the Snake River Plain and youngest on the Yellowstone Plateau, which overlies the thermal plume today. The plain is a 640-km (400-mi) trail made by the passage of the continent over this hot spot. The basalts that are visible on much of the plain today are younger than the rhyolites they cover. However, many of the rhyolite buttes have pushed up through the overlying basalts and, therefore, younger than the basalts. The flat basalt cap on Middle Butte is a good illustration of this process.

Humans first appeared on the Upper Snake River Plain approximately 11,000 years ago, likely descendants of people who crossed the Bering Strait land bridge. Tools recovered from this period indicate these earliest human inhabitants were almost certainly hunters of large game. The ancestors of the present-day Shoshone and Bannock people came north from the Great Basin around 4500 years ago (ESRF 1996).

The earliest exploratory visits by European descendants came between 1810 and 1840. Trappers and fur traders were some of the first to make their way across the plain seeking new supplies of beavers for pelts. Between 1840 (by which time the fur trade was essentially over) and 1857, an estimated 240,000 immigrants passed through southern Idaho on the Oregon Trail.

By 1868, treaties had been signed forcing the native populations onto the reservation at Fort Hall. During the 1870s, miners entered the surrounding mountain ranges, followed by ranchers grazing cattle and sheep in the valleys.

A railroad was opened between Blackfoot and Arco, Idaho, in 1901. By this time, a series of acts (the Homestead Act of 1862, the Desert Claim Act of 1877, the Carey Act of 1894, and the Reclamation Act of 1902) provided sufficient incentive for homesteaders to attempt to build diversionary canals to claim the desert. Most of these canal efforts failed because of the extreme porosity of the gravelly soils and underlying basalts.

During World War II, large guns from U.S. Navy warships were retooled at the U.S. Naval Ordnance Station in Pocatello, Idaho. These guns needed to be tested, and the nearby uninhabited plain was put to use as a gunnery range, then known as the Naval Proving Ground. The U.S. Army Air Corps also trained bomber crews out of the Pocatello Airbase and used the area as a bombing range.

After the war ended, the nation turned to peaceful uses of atomic power. The DOE's predecessor, the U.S. Atomic Energy Commission (AEC), needed an isolated location with an ample groundwater supply on which to build and test nuclear power reactors. The relatively isolated Snake River Plain was chosen as the best location. Thus, the Naval Proving Ground became the National Reactor Testing Station (NRTS) in 1949.

By the end of 1951, a reactor at the NRTS (EBR-I) became the first to produce useful electricity. The Site evolved into an assembly of 52 reactors, associated research centers, and waste handling areas. The NRTS was renamed the Idaho National Engineering Laboratory in 1974 and Idaho National Engineering and Environmental Laboratory in January 1997. The AEC was renamed the U.S. Energy Research and Development Administration in 1975 and reorganized to the present-day DOE in 1977.

1.4 Regional Economic Impact

Approximately 7000 people work at the INEEL, making it the largest employer in eastern Idaho and one of the top five employers in the State. This number includes about 400 federal employees, most of who work for DOE-ID. The majority of the other 6600 employees work for the M&O contractor at the INEEL. Other employees work for contractors at facilities operated by other DOE organizations, such as BBI at NRF, the University of Chicago at ANL-W, and BNFL, Inc. at the Advanced Mixed Waste Treatment Facility at the RWMC.

The INEEL infuses more than $750 million dollars into the Idaho economy through the purchase of goods and services, corporately funded economic development, and contributions to the State and local tax base.

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